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Raubvogel

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(54) **AUTOMATIC ACTIVATION OF TURN SIGNALS IN A VEHICLE**

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B60R 16/03 (2006.01)

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CPC ***B60K 37/06*** (2013.01); *B60R 16/0315* (2013.01)

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USPC 701/36
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,740,547 A * 4/1998 Kull et al. 701/19
5,742,925 A * 4/1998 Baba 701/469
5,905,433 A * 5/1999 Wortham 340/431
5,926,113 A * 7/1999 Jones et al. 340/906
5,986,575 A * 11/1999 Jones et al. 340/906
6,151,539 A * 11/2000 Bergholz et al. 701/25
6,975,218 B2 * 12/2005 Madau 340/476
7,843,360 B2 * 11/2010 Ponziani 340/901

* cited by examiner

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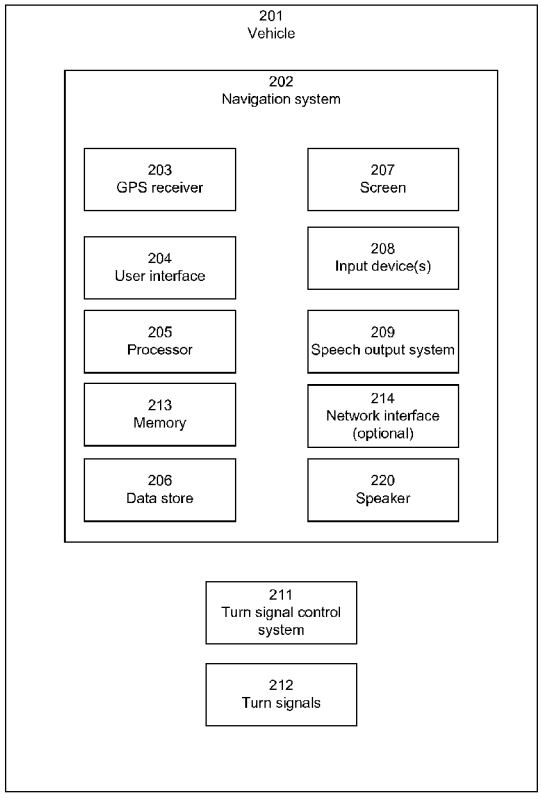
(57) **ABSTRACT**

According to various embodiments, turn signals are automatically activated in response to signals received from a navigation system, based on the navigation instructions generated by the navigation system. The navigation system of a vehicle (either built into the vehicle or provided as a stand-alone unit) is communicatively coupled with or otherwise integrated with the turn signals of the vehicle. When the navigation system instructs the driver to perform a maneuver (such as making a turn), it can also cause the appropriate turn signal to be automatically activated at the appropriate time and/or distance in advance of the maneuver. When the navigation system detects that the maneuver has been made, or that the driver has ignored the system's instructions, the turn signal can be automatically deactivated.

27 Claims, 10 Drawing Sheets



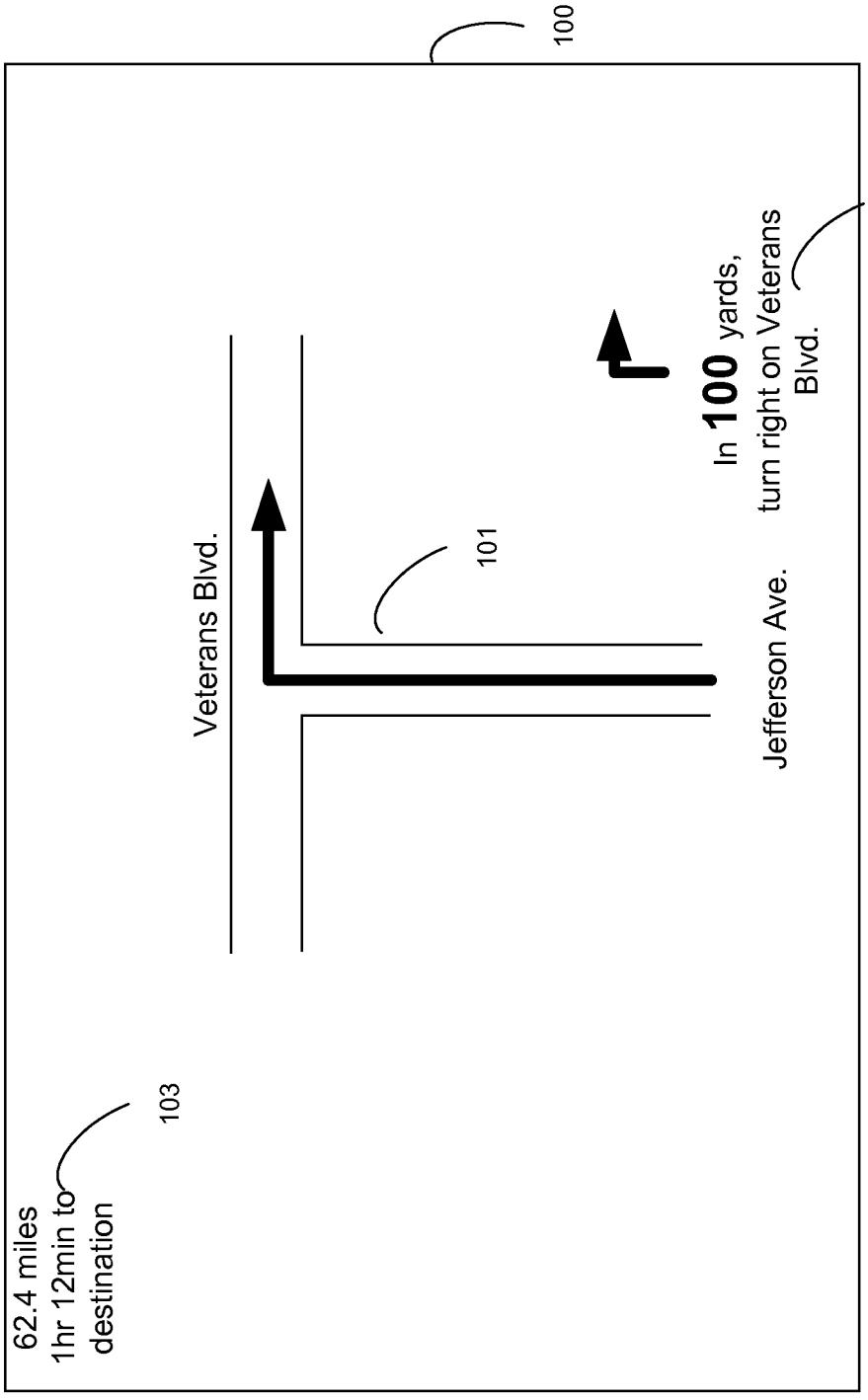


FIG. 1
(PRIOR ART)

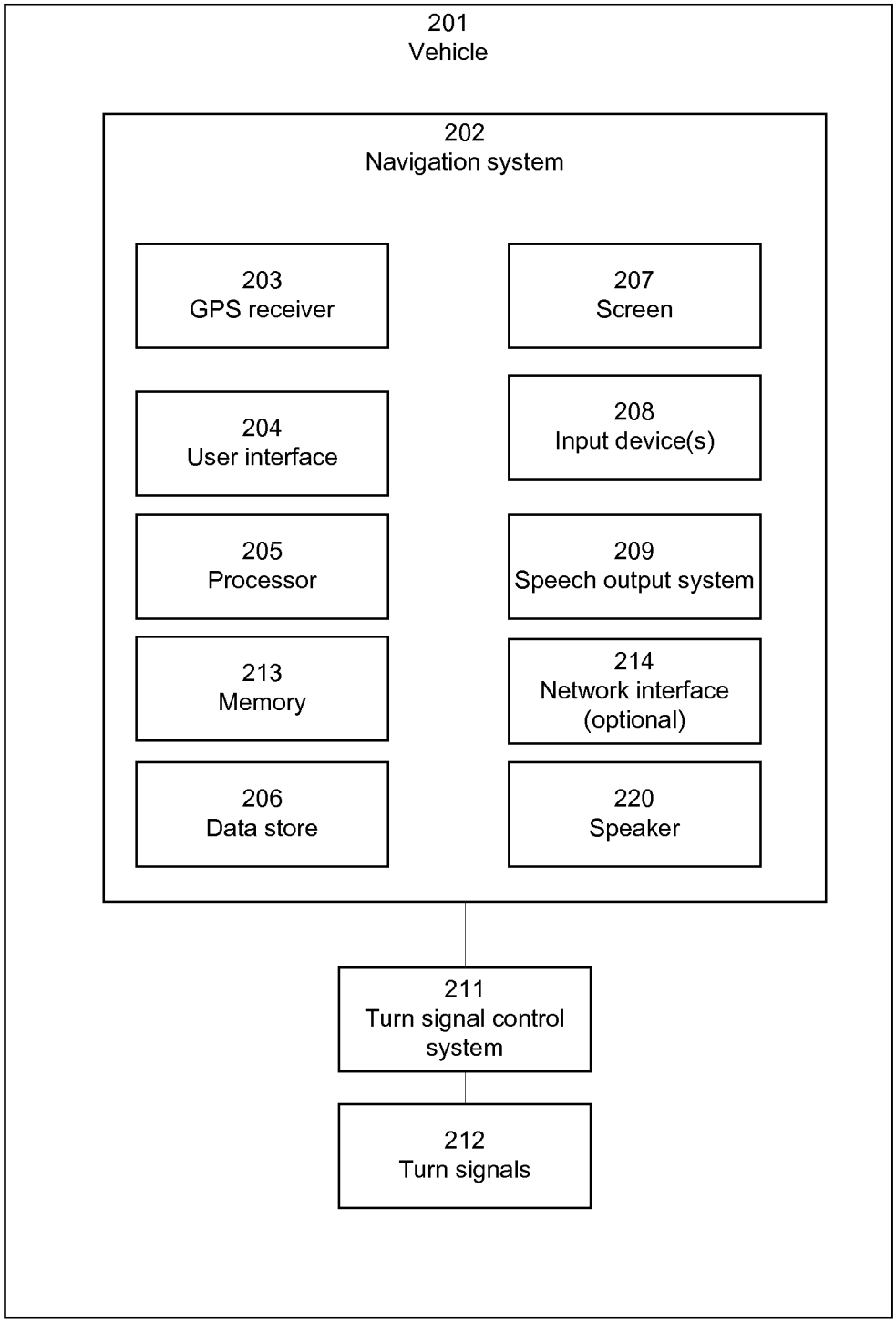

201
Vehicle
202
Navigation system
203
GPS receiver
207
Screen
204
User interface
208
Input device(s)
205
Processor
209
Speech output system
213
Memory
214
Network interface
(optional)
206
Data store
220
Speaker
211
Turn signal control
system
212
Turn signals

FIG. 2

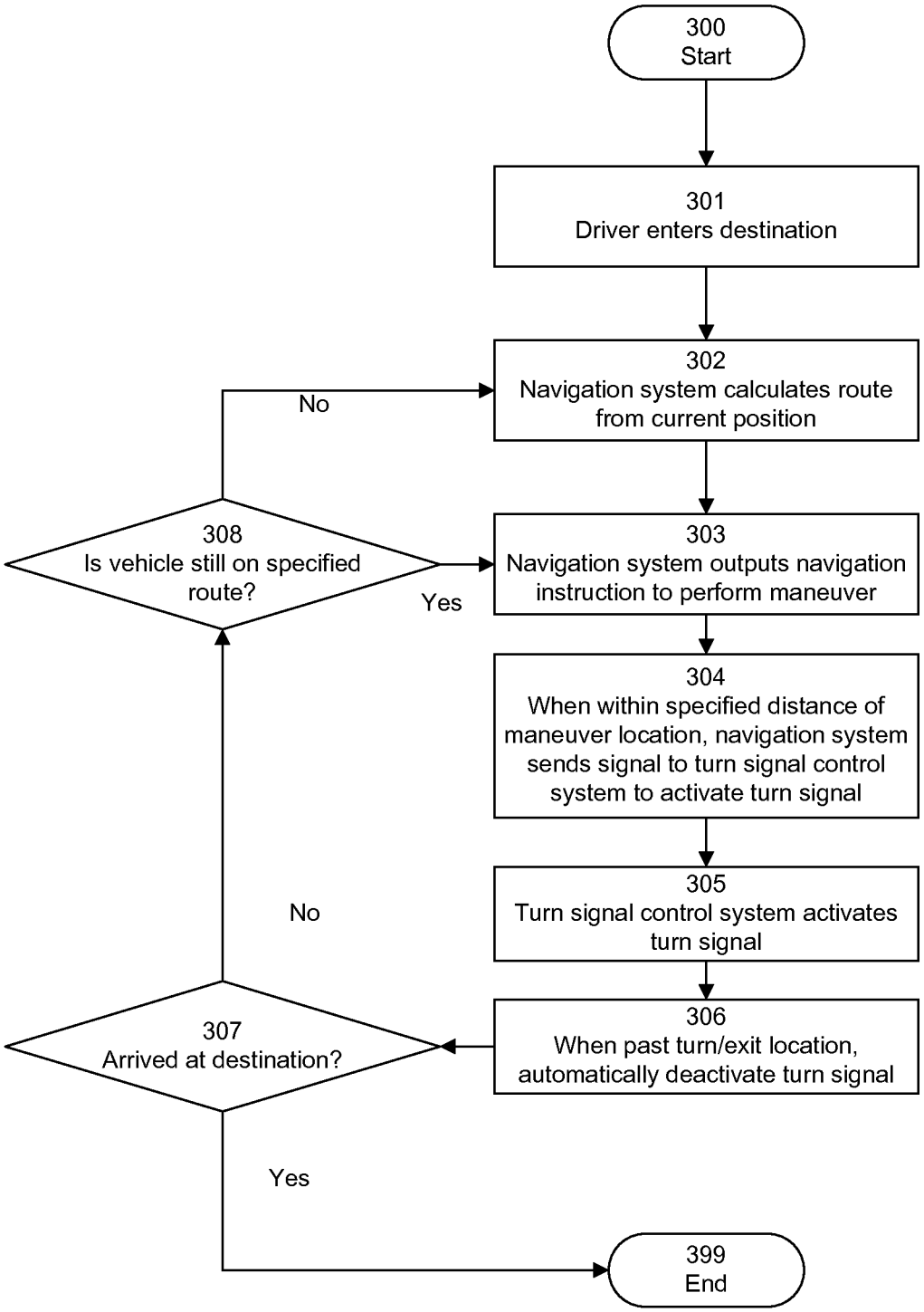

300
Start
301
Driver enters destination
302
Navigation system calculates route from current position
No
308
Is vehicle still on specified route?
Yes
303
Navigation system outputs navigation instruction to perform maneuver
304
When within specified distance of maneuver location, navigation system sends signal to turn signal control system to activate turn signal
305
Turn signal control system activates turn signal
No
307
Arrived at destination?
306
When past turn/exit location, automatically deactivate turn signal
Yes
399
End

FIG. 3

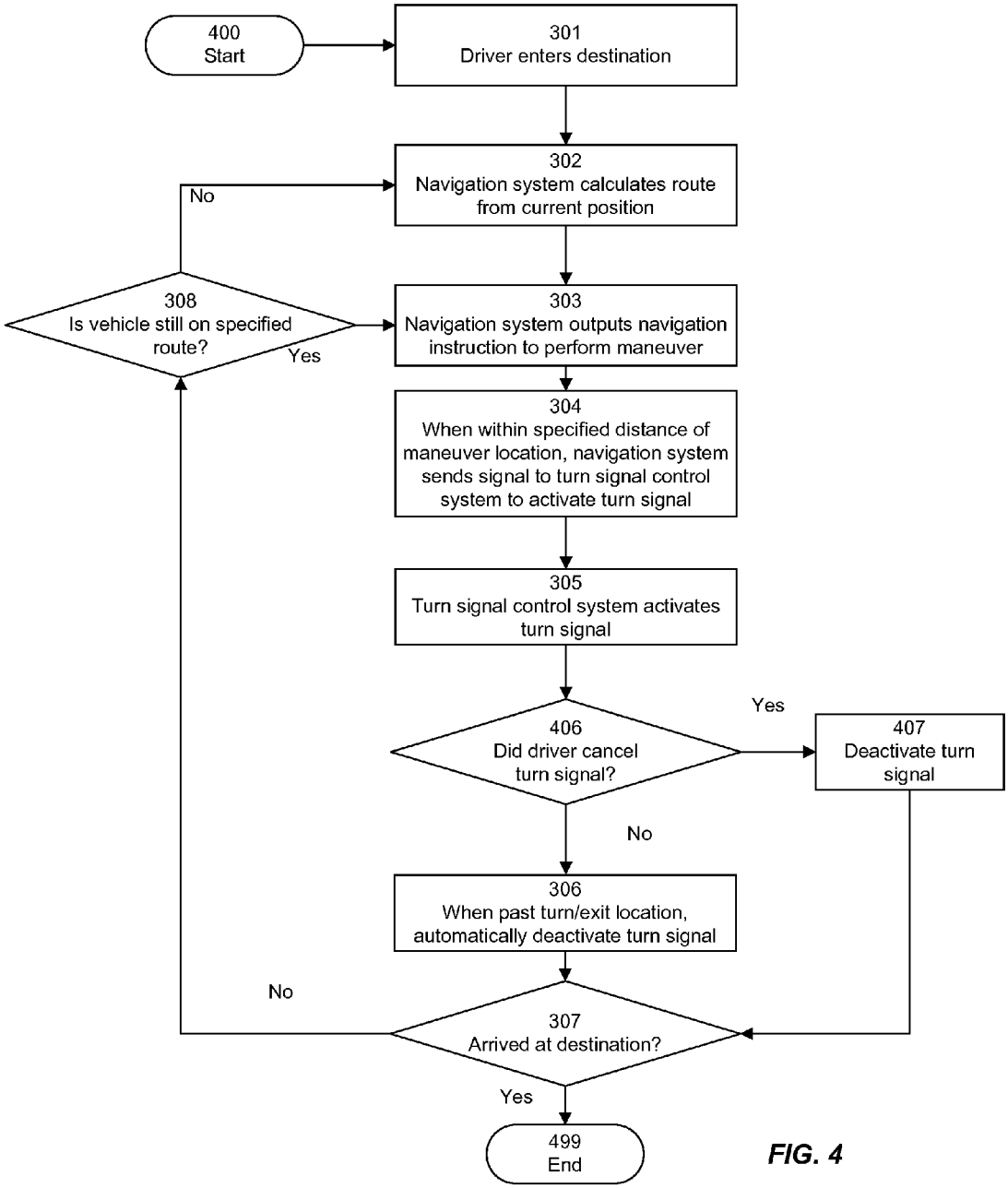

400
Start
301
Driver enters destination
302
Navigation system calculates route from current position
No
308
Is vehicle still on specified route?
Yes
303
Navigation system outputs navigation instruction to perform maneuver
304
When within specified distance of maneuver location, navigation system sends signal to turn signal control system to activate turn signal
305
Turn signal control system activates turn signal
406
Did driver cancel turn signal?
Yes
407
Deactivate turn signal
No
306
When past turn/exit location, automatically deactivate turn signal
No
307
Arrived at destination?
Yes
499
End

FIG. 4

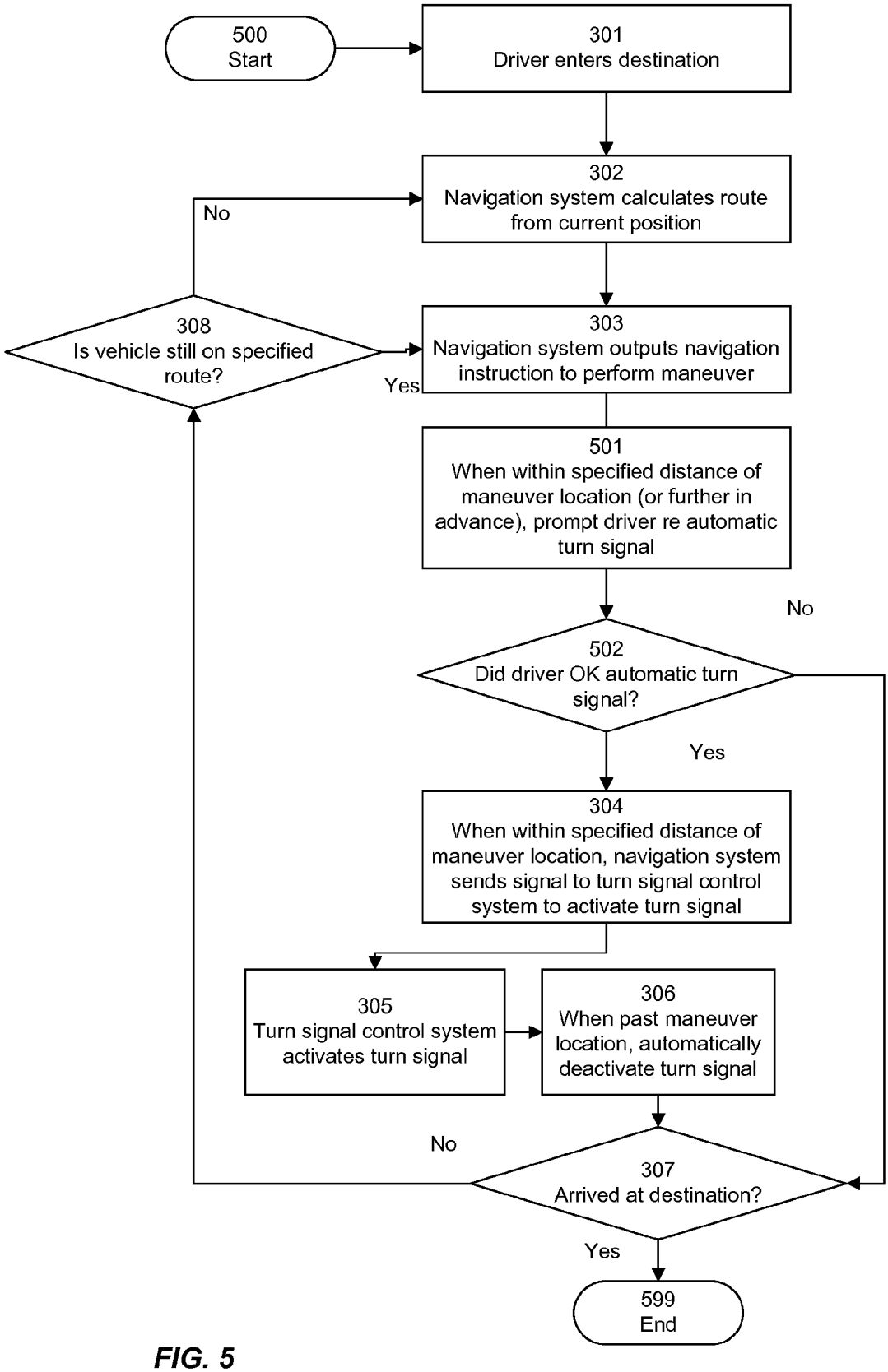

500
Start
301
Driver enters destination
302
Navigation system calculates route from current position
No
308
Is vehicle still on specified route?
Yes
303
Navigation system outputs navigation instruction to perform maneuver
501
When within specified distance of maneuver location (or further in advance), prompt driver re automatic turn signal
No
502
Did driver OK automatic turn signal?
Yes
304
When within specified distance of maneuver location, navigation system sends signal to turn signal control system to activate turn signal
305
Turn signal control system activates turn signal
306
When past maneuver location, automatically deactivate turn signal
No
307
Arrived at destination?
Yes
599
End

FIG. 5

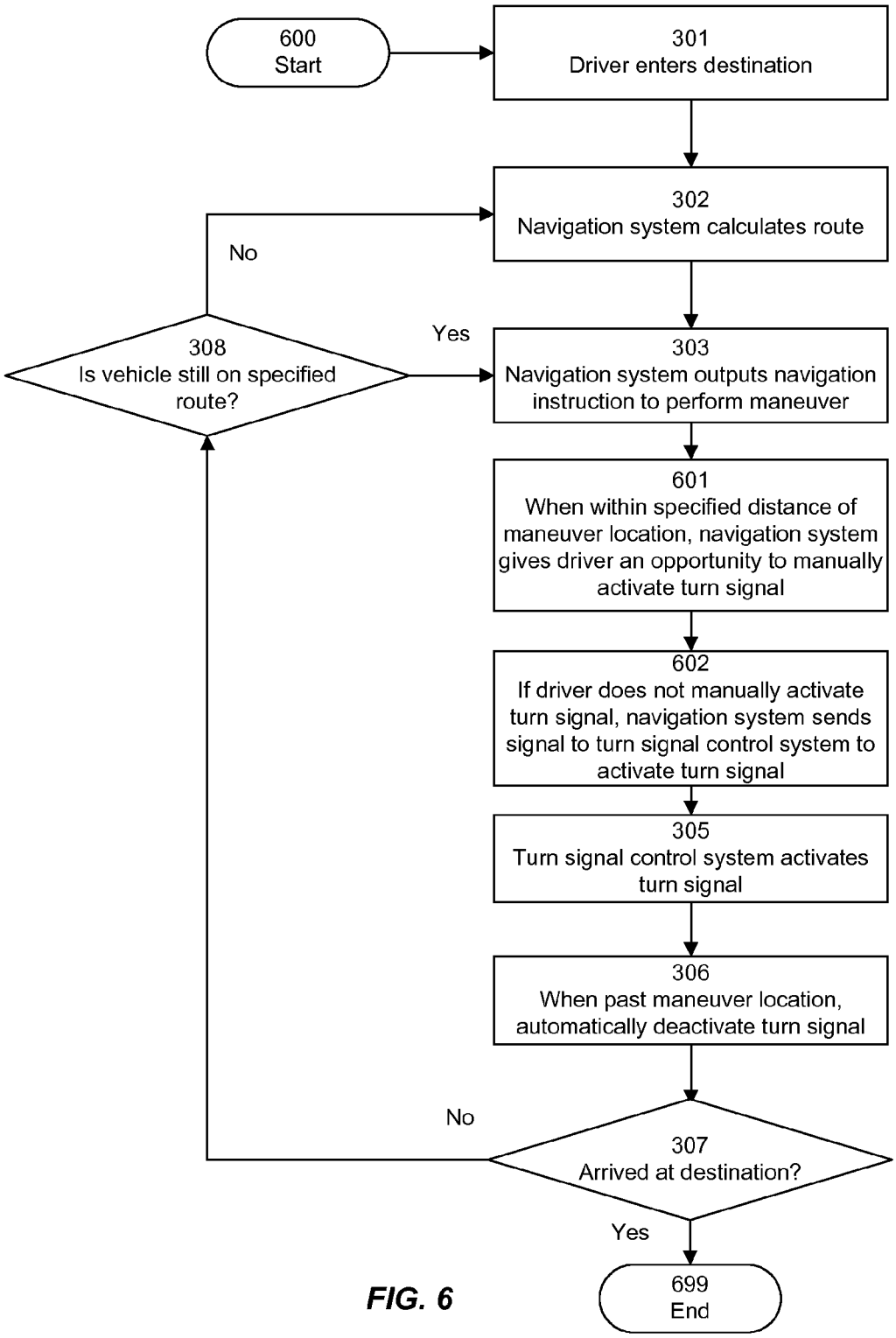

600
Start
301
Driver enters destination
302
Navigation system calculates route
No
308
Is vehicle still on specified route?
Yes
303
Navigation system outputs navigation instruction to perform maneuver
601
When within specified distance of maneuver location, navigation system gives driver an opportunity to manually activate turn signal
602
If driver does not manually activate turn signal, navigation system sends signal to turn signal control system to activate turn signal
305
Turn signal control system activates turn signal
306
When past maneuver location, automatically deactivate turn signal
No
307
Arrived at destination?
Yes
699
End

FIG. 6

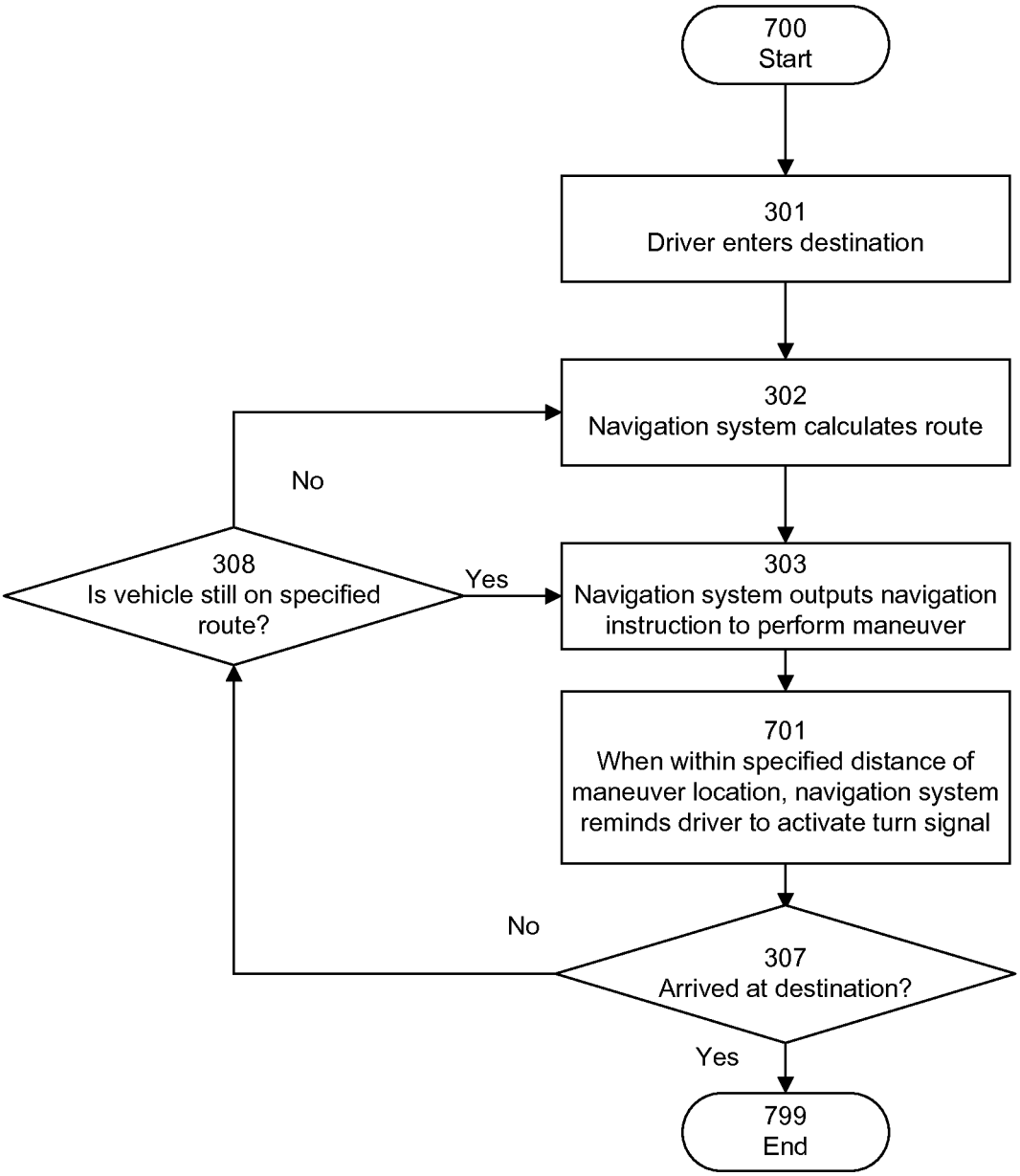

700
Start
301
Driver enters destination
302
Navigation system calculates route
No
308
Is vehicle still on specified route?
Yes
303
Navigation system outputs navigation instruction to perform maneuver
701
When within specified distance of maneuver location, navigation system reminds driver to activate turn signal
No
307
Arrived at destination?
Yes
799
End

FIG. 7

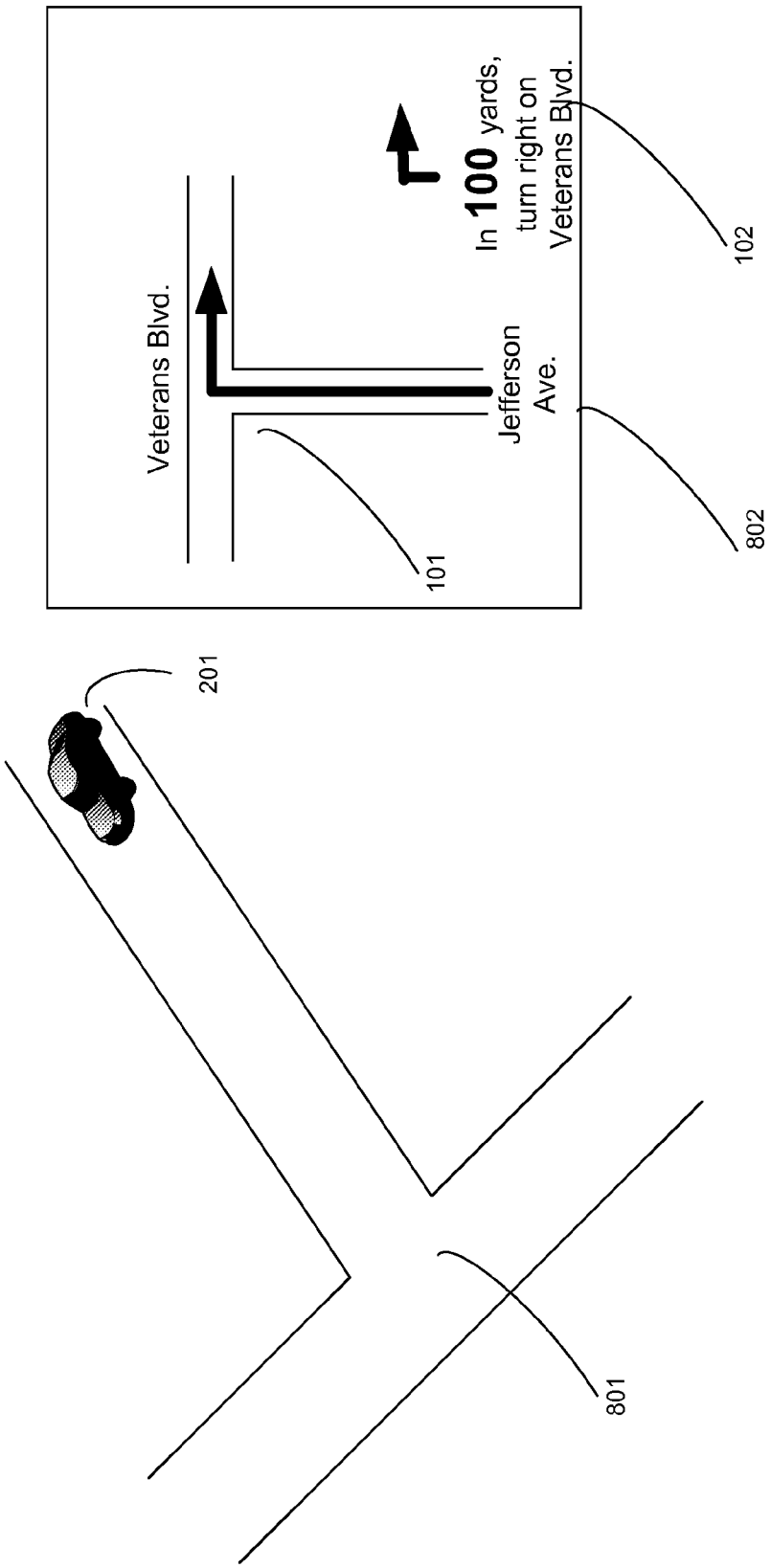

Veterans Blvd.
Jefferson Ave.
In 100 yards, turn right on Veterans Blvd.
101
102
201
801
802

FIG. 8A

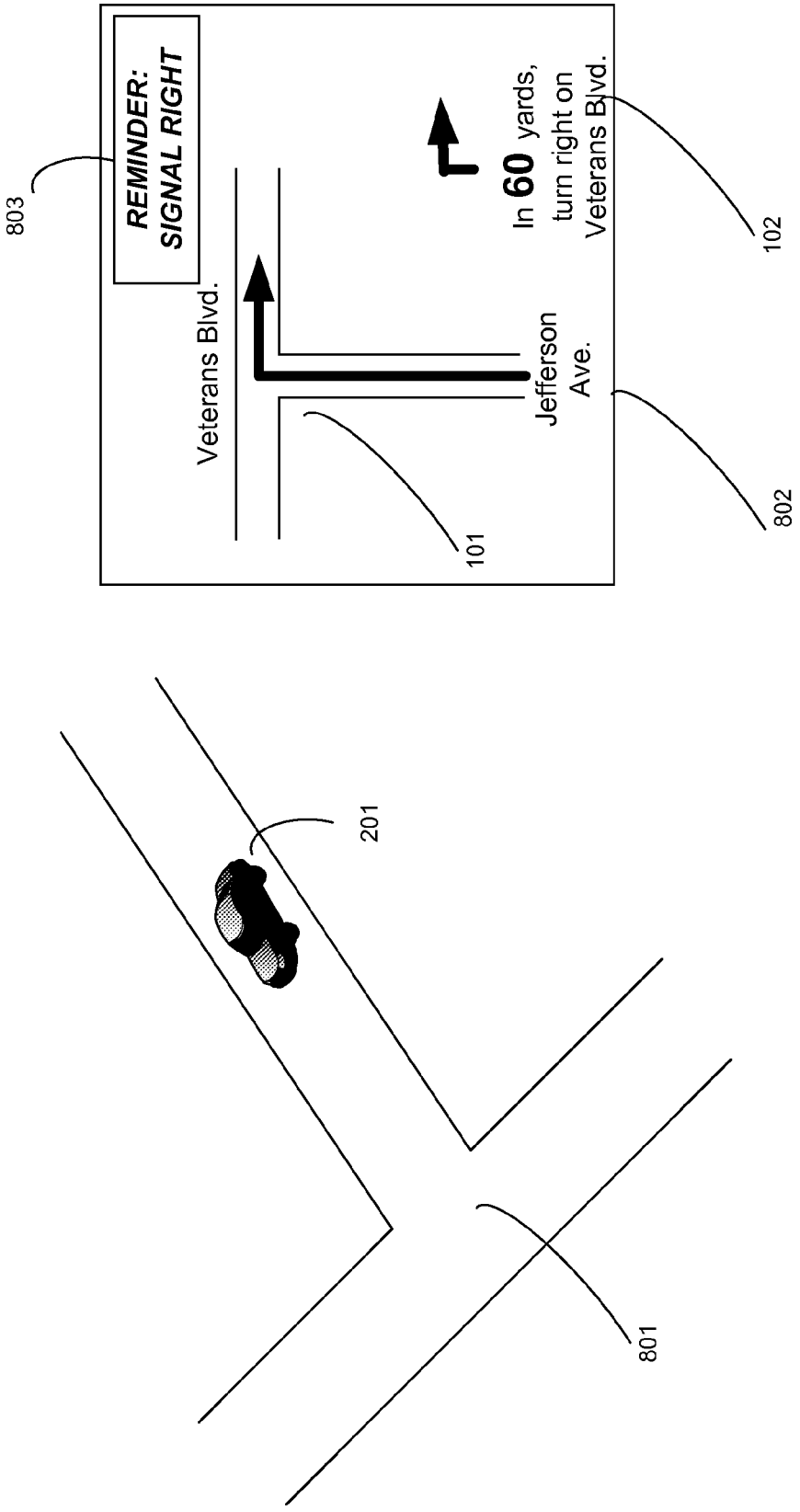
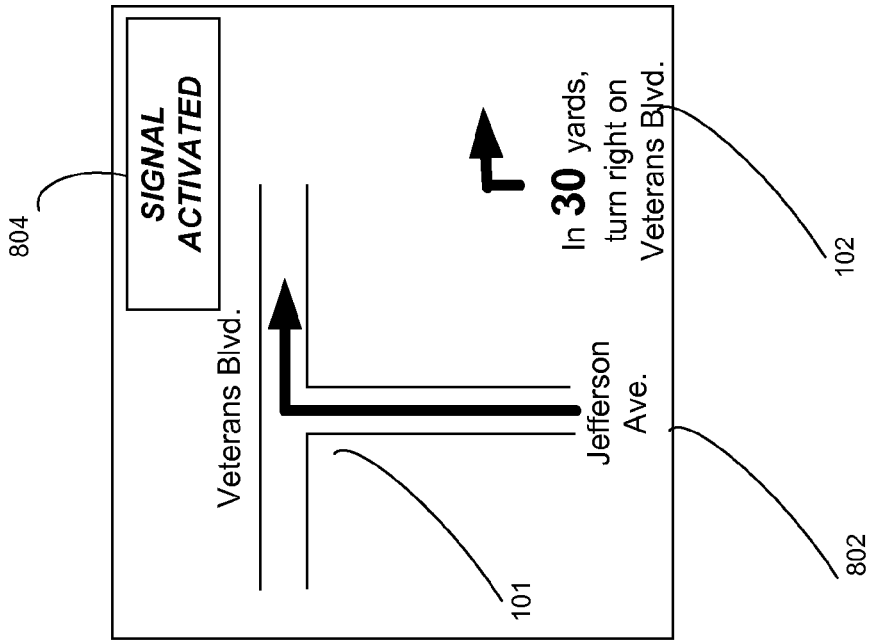

803
REMINDER:
SIGNAL RIGHT
Veterans Blvd.
Jefferson
Ave.
In 60 yards,
turn right on
Veterans Blvd.
102
802
101
201
801

FIG. 8B


804
SIGNAL ACTIVATED
Veterans Blvd.
Jefferson Ave.
In 30 yards, turn right on Veterans Blvd.
102
802
101

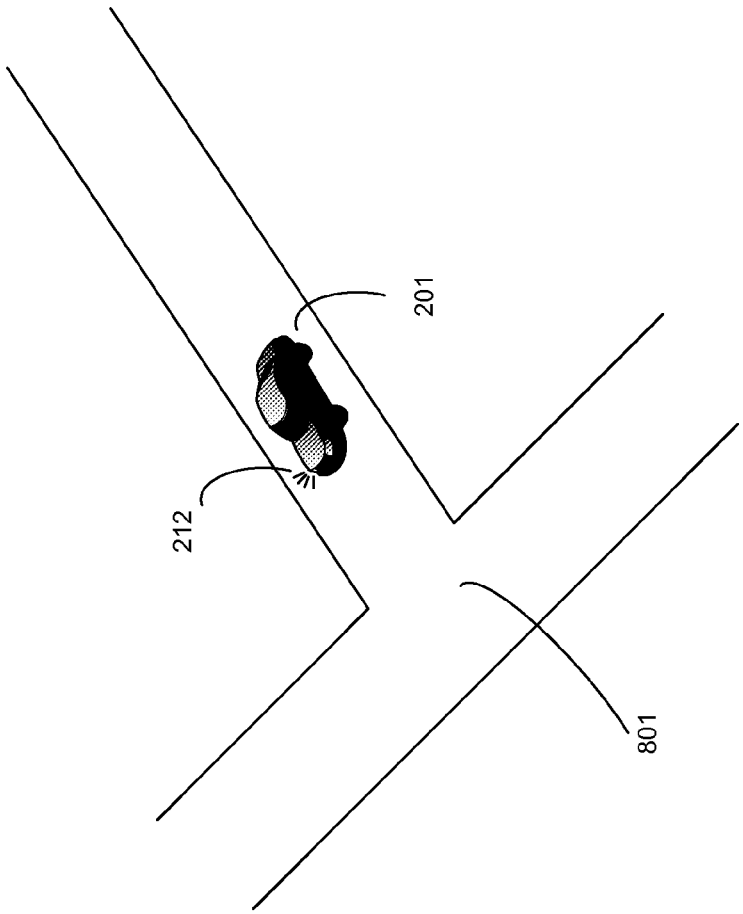

201
212
801

FIG. 8C

AUTOMATIC ACTIVATION OF TURN SIGNALS IN A VEHICLE

FIELD OF THE INVENTION

The present invention relates to turn signals, or directional indicators, in vehicles, and more particularly to a system and method for automatically activating turn signals on a vehicle.

DESCRIPTION OF THE RELATED ART

In-car navigation systems employing Global Position System (GPS) technology are well known. Such systems provide drivers with a series of instructions and/or information to guide the driver to a specified destination. Typically, such instructions are provided via visual and/or auditory means. For example, once a driver has indicated a specified destination, a display screen may show a map of the route and/or a graphical depiction of an upcoming turn, entrance, exit, or intersection, while a spoken voice can provide instructions to the driver. Instructions can tell the driver to perform any suitable maneuver, such as for example, turns, freeway exits/entrances, lane changes, and the like.

Particular examples of instructions and information provided by navigation systems include, without limitation:

"In 500 feet, turn right"

"Stay in the right lane"

"In 1 mile, turn right onto El Camino Real"

"Your destination is ahead on the right"

Referring now to FIG. **1**, there is shown an example of a screen **100** that may be used for outputting instructions according to the prior art. In the example, map **101** is shown, along with instructions **102** and an indication **103** of the distance and estimated time remaining in the trip. One skilled in the art will recognize that different navigation systems may offer such information and/or other information in many different formats.

The driver is free to follow or ignore the instructions as he or she sees fit. In many navigation systems, a new route to the destination is generated if the driver veers from the system's instructions.

Whether or not they are following a route specified by a navigation system, drivers often forget to activate their turn signals (directional indicators) when driving. This may occur because a driver is distracted, or careless, or sim-ply finds it too difficult or burdensome to use turn signals. Such failure to activate turn signals is a violation of traffic laws in most jurisdictions, and can lead to accidents because other drivers or pedestrians may not be aware of an intended action such as a turn or change of lanes.

SUMMARY

According to various embodiments of the present invention, turn signals are automatically activated in response to signals received from a navigation system, based on the navigation instructions generated by the navigation system. The navigation system of a vehicle (either built into the vehicle or provided as a stand-alone unit) is communicatively coupled with or otherwise integrated with the turn signal mechanism of the vehicle. When the navigation system instructs the driver to perform a maneuver (such as making a turn), it can also cause the appropriate turn signal to be automatically activated at the appropriate time and/or distance in advance of the maneuver. When the navigation system detects that the maneuver has been made, or that the driver has ignored the system's instructions, the turn signal can be automatically deactivated.

In one embodiment, the user can cancel the automatically activated turn signal after it has been activated. In another embodiment, the user can specify under what conditions the turn signal should be automatically activated based on instructions from the navigation system. For example, the user can, in one embodiment, specify the distance (before the intersection or other location) at which the turn signal should be automatically activated. In another embodiment, the interface of the navigation system can prompt the user as to whether the turn signal should be automatically activated. Such prompting can take place for each route instruction (i.e. as the route instruction is given), or for the entire session/drive, or it can be a setting that remains in effect until changed by the driver.

For example, if the navigation system instructs the driver to turn right at an upcoming intersection, it can cause the right-turn signal to be automatically activated at a specified distance in advance of the intersection. The signal can be canceled manually by the user. If the user makes the turn, the signal is canceled automatically. Additionally, if the user ignores the instructions, for example by proceeding straight through the intersection or making a left turn, in one embodiment the turn signal is also canceled automatically.

Further details and variations are described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate several embodiments of the invention and, together with the description, serve to explain the principles of the invention according to the embodiments. One skilled in the art will recognize that the particular embodiments illustrated in the drawings are merely exemplary, and are not intended to limit the scope of the present invention.

FIG. **1** depicts an example of a screen as may be displayed by a navigation system according to the prior art.

FIG. **2** is a block diagram depicting an architecture for practicing the present invention according to one embodiment of the present invention.

FIG. **3** is a flow diagram depicting a method for practicing the present invention according to one embodiment, wherein turn signals are automatically activated based on navigation instructions.

FIG. **4** is a flow diagram depicting a method for practicing the present invention according to one embodiment, wherein the driver can optionally cancel the automatic turn signal.

FIG. **5** is a flow diagram depicting a method for practicing the present invention according to one embodiment, wherein the system prompts the driver as to whether a turn signal should be automatically activated.

FIG. **6** is a flow diagram depicting a method for practicing the present invention according to one embodiment, wherein the system gives the driver an opportunity to manually activate a turn signal before automatically activating the turn signal.

FIG. **7** is a flow diagram depicting a method for practicing the present invention according to one embodiment, wherein the system reminds the driver to activate the turn signal.

FIGS. **8**A through **8**C depict an example of the operation of the present invention according to one embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

System Architecture

According to various embodiments, the present invention can be implemented in a navigation system installed in a vehicle, or in a component that can be communicatively coupled with a navigation system. Such a navigation system can be a built-in system installed by the vehicle manufacturer, or it can be an after-market system. Alternatively, the invention can be implemented in a stand-alone or portable navigation system, handheld or mobile computing device, laptop computer, desktop computer, personal digital assistant (PDA), cellu-lar telephone, smartphone, music player, tablet computer, or the like, or any other device capable of generating routing instructions for a driver to follow. Such device may operate in a stand-alone fashion, using locally stored geographic data, or it can operate by connecting with a server containing geographic data; such communication can take place over the Internet, or over any suitable wireless data network, or any other suitable network. Alternatively, the techniques described herein can be implemented on any other type of computing device, combination of devices, or platform.

In some embodiments, the system of the present invention may be communicatively coupled to a turn signal control system or circuit of a vehicle, so as to be able to send signals to such a control system in order to automatically active turn signals. Such communication can take place over any suitable wired or wireless communications medium; for example, such communication can take place using a wireless communications protocol such as BlueTooth. In other embodiments, the system can be implemented using any other suitable mechanism for enabling a signal to be sent from a navigation system to a turn signal control system or circuit of a vehicle.

Although the invention is described herein in the context of automatically activating turn signals in a vehicle, one skilled in the art will recognize that the techniques of the present invention can be implemented in other contexts. Accordingly, the following description is intended to illustrate various embodiments of the invention by way of example, rather than to limit the scope of the claimed invention.

In one embodiment, the present invention is implemented as a feature of software that enables operation of a navigation system in a vehicle or on an electronic device. Such a feature may be part of the navigation system software itself, or it may be implemented as a plug-in or additional application or "app" that may be installed on the device that implements the navigation system software.

Referring now to FIG. **2**, there is shown a block diagram depicting a hardware architecture for practicing the present invention according to one embodiment. Such an architecture can be used, for example, for implementing the techniques of the present invention in connection with a navigation system installed in vehicle **201**. As discussed above, navigation system **202** may be a pre-installed component of vehicle **201**, or one that is installed later, or it may be a stand-alone or portable unit. Navigation system **202** includes various components that are well known in the art. GPS receiver **203** receives signals from GPS satellites to determine the current location of vehicle **201**. Data store **206** includes information such as road information, geographical information, points of interest, and the like. Data store **206** can be organized according to any suitable scheme, including for example as a relational database. Data store **206** can be embodied on any appropriate physical medium or media, including for example and without limitation, a hard drive, an optical drive, flash memory, random access memory, network-based or cloud-based media, and/or the like, and/or any combination thereof. Network interface **214** is an optional component that al-lows navigation system **202** to communicate with remotely located servers, via wired and/or wireless communication mechanisms, such as for example 3G. Navigation system **202** can thereby obtain street, traffic, and/or routing information from remote sources.

Processor **205** may be a microprocessor or any similar component for running software to implement the various features and functions of navigation system **202**. In one embodiment, processor **205** runs software to implement these features and functions. In one embodiment, processor **205** uses location information from GPS receiver **203** together with road information from data store **206** (and/or information received from a remote server via network interface **214**) to determine a suitable route for the driver to follow in order to reach a specified destination. Processor **205** determines the route using well known mechanisms, which may take into account distance, expected speed of various roads, road conditions, driver preferences (e.g. maximize or minimize freeways), road clo-sures, and/or the like. Once a route has been determined, processor **205** is able to generate screen output such as shown in the example of FIG. **1**. Such output may be displayed on screen **207**, which may be integrated into vehicle **201** or may be a separate component. Screen output may be accompanied by spoken instructions generated by speech output system **209** and output via speaker **220**. Memory **213** can be random-access memory having a structure and architecture as are known in the art, for use by processor **205** in the course of running software.

Navigation system **202** may also include any suitable form of input device(s) **208**, which may include, for example and without limitation, a touch-screen, knob, switches, buttons, keyboard, pointing device, five-way switch, joy-stick, dial, steering-wheel mounted controls, speech recognition system (with microphone for receiving spoken audio from the driver), touchpad, and/or the like. Any number of such input device(s) **208** can be provided, either singly or in any combination. If input device **208** includes a speech recognition system, such a system can use any suitable speech-to-text system or technology as may be known in the art. In one embodiment, input device(s) **208** can be used by the driver to specify a desired destination, respond to prompts, and issue various commands relevant to the operation of navigation system **202**.

In one embodiment, a user interface **204** is implemented, for example in software running on processor **205**. User interface **204** presents output to the driver via screen **207**, including for example a display of a route to the specified destination, on-screen prompts and options, and the like. User interface **204** is also configured to accept input from the driver according to an appropriate input mode for input device(s) **208**, including specification of destination, responses to prompts, and the like.

As mentioned above, in one embodiment, under the direction of user interface **204**, system **202** may also provide audio output, including for example spoken output, alert sounds, and/or the like. Speech output system **209** may be configured to generate spoken output to instruct the user according to the specified route. Speech output system **209** can use any known text-to-speech system and/or technology for generating spoken output. As is known in the art, such spoken output may include instructions to make certain turns, lane changes, exits and entrances, and the like. Speech output system **209** sends such spoken input to speaker **220** for output to the driver.

Speaker **220** may be installed in vehicle **201** or may be a component of a stand-alone navigation system **202**. Alternatively, speaker **220** may also be a component of a headset (not shown) worn by driver.

Turn signal control system **211** can be any suitable control system for activating turn signals **212**. More particularly, turn signal control system **211** can be any suitable mechanism for transmitting electrical signals to cause turn signals **212** to operate. For example, turn signal control system **211** can include a thermal flasher or any suitable electronic equivalent; such system **211** can include circuitry for causing turn signals **212** to blink in an intermittent fashion. Turn signals **212** themselves can be any visual and/or auditory indicator(s), including for example incandescent, fluorescent, or other type of light bulb(s), light emit-ting diode(s) (LED(s)), speaker(s), and the like. In one embodiment, multiple turn signals **212** are available, for example to indicate right turns and left turns. In one embodiment, turn signals **212** are located in various locations on vehicle **201**, including for example the front, rear, and/or sides of vehicle **201**.

In one embodiment, navigation system **202** is communicatively coupled, either directly or indirectly, with turn signal control system **211** of vehicle, so as to enable navigation system **202** to send signals to turn signal control system **211** to activate turn signals **212** of vehicle **201** automatically based on route instructions generated or received by navigation system **202**. Thus, in one embodiment, if vehicle **201** is approaching a location where the determined route indicates that a maneuver such as a right turn or right exit should be performed, the system of the present invention sends a signal to turn signal control system **211** to cause right-hand turn signal(s) **212** to be automatically activated. Conversely, in one embodiment, if vehicle **201** is approaching a location where the determined route indicates that a maneuver such as a left turn or left exit should be performed, the system of the present invention sends a signal to turn signal control system **211** to cause left-hand turn signal(s) **212** to be automatically activated.

Communication between navigation system **202** and turn signal control system **211** can be accomplished using any suitable wired or wireless signal transmission means. One example, without limitation, is the BlueTooth protocol, although any other personal area network for wireless signal transmission can be used. Alternatively, navigation system **202** can transmit signals to turn signal control system **211** via a wired transmission path for digital signals. As described in more detail below, navigation system **202** can, in one embodiment, transmit a signal to cause turn signal control system **211** to automatically activate turn signals **212** when vehicle **201** is approaching an intersection, entrance/exit ramp, or other location where the determined route indicates that a maneuver (such as a turn, entrance, exit, or lane change) should be performed. Under the expectation that the driver will perform the specified maneuver, the system of the present invention thus provides a mechanism by which turn signals **212** can be automatically activated.

One skilled in the art will recognize that the particular arrangement of hardware elements shown in FIG. **2** is merely exemplary, and that the invention can be implemented using different hardware elements configured in any of a number of different ways. Thus, the particular architecture shown in FIG. **2** is merely illustrative and is not intended to limit the scope of the invention in any way. In particular, in one embodiment, the system of the present invention can communicate with one or more server(s) via any suitable communications network such as the Internet, and that any of the components depicted in FIG. **2** can be implemented as a server-based component according to well known techniques.

Method of Operation

In one embodiment, the system automatically activates the appropriate turn signal **212** at a specified distance before a maneuver location as specified by the route instructions. In another embodiment, the system of the present invention gives the driver an opportunity to cancel an automatically activated turn signal **212**. In yet another embodiment, the system of the present invention gives the driver an opportunity to manually activate turn signal **212**; however, if the driver forgets to do so, the system automatically activates the appropriate turn signal **212**. In yet another embodiment, the system prompts the driver to indicate whether or not turn signal **212** should be activated; if the driver indicates an af-firmative response, by whatever input mechanism is appropriate, the system automatically activates turn signal **212**. In yet another embodiment, the system prompts the driver to remind him or her to activate the appropriate turn signal **212**, but does not activate turn signal **212** automatically.

These various embodiments will be described with reference to FIGS. **3** through **7**.

FIG. **3** is a flow diagram depicting a method for practicing the present invention according to one embodiment of the present invention, wherein turn signals **212** are automatically activated responsive to navigation instructions from navigation system **202**.

The driver enters **301** a destination into navigation system **202**, using any suitable input device(s) **208**. Destination can be entered using knobs, dials, buttons, touch-screen, voice input, and/or any combination thereof.

Navigation system **202** calculates **302** a route to the specified destination, based on vehicle's **201** current position as determined by GPS receiver **203**, and further based on road information and/or other information stored in data store **206** and/or obtained from a server. Such route calculation can be performed using any suitable techniques as are known for use in navigation systems.

As vehicle **201** travels along the route, navigation system **202** outputs **303** any number of navigation instructions for the driver to follow. Each navigation instruction specifies a maneuver such as a turn, exit, entrance, lane change, the like. The system of the present invention can output **303** instructions using any technique and/or methodology that may be known for such output **303** in a navigation system. Such instructions can be output **303**, for example, as a series of spoken instructions via speech output system **209**, and/or instructions displayed on screen **207**. In one embodiment, each successive instruction is output **303** as vehicle **201** approaches the intersection, entrance/exit ramp, or other geographical location where the instruction is to be followed. In other embodiments, any number of instructions can be output **303** simultaneously or in advance of reaching the intersection(s), entrance/exit ramp(s), or other geographical location(s) where the instructions are to be followed. Instructions can be present in textual, graphical, spoken, and/or other form. As is known in the art, instructions can be accompanied by a map or other display, which may change continually to reflect vehicle's **201** current position.

In one embodiment, when vehicle **201** is within a specified distance of an intersection, entrance/exit ramp, or other geographical location where an instruction is to be followed, navigation system **202** sends **304** a signal to turn signal control system **211** of vehicle **201** to cause system **211** to automatically activate appropriate turn signal(s) **212** reflecting the maneuver specified by the instruction. For example, if the

specified maneuver is a right turn or right exit, navigation system **202** may cause turn signal control system **211** to activate right turn signal(s) **212**. Conversely, if the maneuver is a left turn or left exit, navigation system **202** may cause turn signal control system **211** to activate left turn signal(s) **212**.

Turn signal control system **211** automatically activates **305** specified turn signal(s) **212** according to the signal received from navigation system **202**. Optionally, navigation system **202** can notify the driver that turn signal(s) **212** have been automatically activated, either via visual or auditory means, or both.

In this manner, turn signal(s) **212** is/are automatically activated based on instructions generated by navigation system **202**.

In one embodiment, once vehicle **201** is past the geographical location where the instruction was to be followed, turn signal control system **211** automatically deactivates **306** turn signal(s) **212**. If the driver caused vehicle **201** to make a turn, such deactivation **306** can take place using known mechanical and/or electrical means for deactivating a turn signal after a turn is made. If, however, the driver ignored the instruction, and/or if the instruction specified a maneuver that was insufficient to deactivate turn signal(s) **212** by conventional means, navigation system **202** can detect that vehicle **201** has passed the geographic location where the instruction was to be followed. In such a situation, in one embodiment, navigation system **202** sends a signal to cause turn signal control system **211** to automatically deactivate **306** turn signal(s) **212**.

If vehicle **201** has arrived **307** at the specified destination, the method ends **399**. Otherwise, in one embodiment, if the driver ignores the instruction, or if vehicle **201** goes off the specified route for any other reason, the method can return to step **302** to recalculate the route. Accordingly, in one embodiment, step **308** determines whether vehicle **201** is still on the specified route. If so, the method returns to step **303**; otherwise the method returns to step **302** to recalculate the route based on the current position of vehicle **201**. Steps **303** through **306** are then repeated.

Referring now to FIG. **4**, there is shown a flow diagram depicting a method for practicing the present invention according to one embodiment of the present invention, wherein the driver can optionally cancel the automatic turn signal. Steps **301** through **305** are performed as described in connection with FIG. **3**. However, once turn signal control system **211** has automatically activated **305** specified turn signal(s) **212** according to the signal received from navigation system **202**, the driver is able to cancel turn signal(s) **212**, either by manipulating turn signal controls in a conventional manner, or by providing a command or other input to navigation system **202**. If the driver cancels **406** turn signal(s) **212**, turn signal control system **211** deactivates **407** turn signal(s) **212**. In one embodiment, if the driver cancels **406** turn signal(s) **212** via navigation system **202**, deactivation **407** can take place responsive to a signal sent from navigation system **202** to turn signal control system **211**.

Steps **306** through **308** are performed as described in connection with FIG. **3**. If, in step **307**, vehicle **201** has arrived at the destination, the method ends **499**.

Referring now to FIG. **5**, there is shown a flow diagram depicting a method for practicing the present invention according to one embodiment of the present invention, wherein the system prompts the driver as to whether turn signal(s) **212** should be automatically activated. Steps **301** through **303** are performed as described in connection with FIG. **3**. Navigation system **202** or some other component prompts **501** the driver to indicate whether turn signal(s) **212** should be automatically activated. In one embodiment, such prompting is performed when vehicle **201** is within a specified distance of a location for performing a maneuver as specified by an instruction generated by navigation system **202**. In another embodiment, such prompting can take place further in advance, for example upon initial output of the navigation instruction. In yet another embodiment, such prompting can take place at the time the driver enters **301** the destination, or at the time the route is initially calculated **302**. The driver's indication as to whether or not turn signal(s) **212** should be automatically activated can be effective for a single navigation instruction, or for an entire route, or it can be a global setting that remains in effect until the driver changes it.

Prompting **501** of the driver can take place by any suitable output mechanism, whether visual and/or auditory; examples include screen **207** and/or speech output system **209**, and/or a beep or other sound. The driver can respond via any suitable input device **208**, such as via a physical or virtual control or button, or voice control. In one embodiment, the system of the present invention can acknowledge the driver's response via any suitable output mechanism.

If the driver indicated that turn signal(s) **212** should be automatically activated **502**, steps **304** through **307** are performed as described in connection with FIG. **3**. If the driver indicated that turn signal(s) **212** should not be automatically activated **502**, the method proceeds directly to step **307** to determine whether or not vehicle **201** has arrived **307** at the specified destination.

If vehicle **201** has arrived **307** at the specified destination, the method ends **599**.

Otherwise, in one embodiment, if the driver ignores the instruction, or if vehicle **201** goes off the specified route for any other reason, the method can return to step **302** to recalculate the route. Accordingly, in one embodiment, step **308** determines whether vehicle **201** is still on the specified route. If so, the method returns to step **303**; otherwise the method returns to step **302** to recalculate the route based on the current position of vehicle **201**. Steps **303** through **306** are then repeated.

Referring now to FIG. **6**, there is shown a flow diagram depicting a method for practicing the present invention according to another embodiment of the present invention, wherein the system gives the driver an opportunity to manually activate turn signal(s) **212** before they are automatically activated.

Steps **301** through **303** are performed as described in connection with FIG. **3**. In one embodiment, when vehicle **201** is within a specified distance of an intersection, entrance/exit ramp, or other geographical location where an instruction is to be followed, navigation system **202** gives **601** the driver an opportunity to manually activate turn signal(s) **212**. For example, navigation system **202** may wait some specified period of time, such as five to ten seconds, to allow the driver to manually activate turn signal(s) **212**. The period of time may de-pend on vehicle **201** velocity, and/or it may reflect a specified traveled distance, or it may be a fixed or predetermined period of time. In one embodiment, such period of time can be configured by the driver or by some other individual.

If the driver does not manually activate turn signal(s) **212** within the period of time, navigation system **202** sends **602** a signal to turn signal control system **211** of vehicle **201** to cause system **211** to automatically activate appropriate turn signal(s) **212** reflecting the instruction. For example, if the maneuver specified by the instruction is a right turn or right exit, navigation system **202** may cause turn signal control system **211** to activate right turn signal(s) **212**. Conversely, if the maneuver specified by the instruction is a left turn or left exit, navigation system **202** may cause turn signal control

system **211** to activate left turn signal(s) **212**. Optionally, output screen **207** of navigation system **202** can notify the driver that turn signal(s) **212** have been automatically activated.

Steps **305** through **308** are performed as described in connection with FIG. **3**. If, in step **307**, vehicle **201** has arrived at the destination, the method ends **699**.

Referring now to FIG. **7**, there is shown a flow diagram depicting a method for practicing the present invention according to one embodiment of the present invention, wherein the system reminds the driver to activate turn signal(s) **212**.

Steps **301** through **303** are performed as described in connection with FIG. **3**. In one embodiment, when vehicle **201** is within a specified distance of an intersection, entrance/exit ramp, or other geographical location where an instruction is to be followed, navigation system **202** outputs **701** a reminder to the driver to activate turn signal(s) **212**. Such reminder can be presented to the driver via any suitable output mechanism, whether visual and/or auditory; examples include screen **207** and/or speech output system **209**, and/or a beep or other sound. For example, speech output system **209** can say, "You are approaching the intersection. Don't forget to signal left.", or some other suitable spoken reminder. Alternatively, or in addition to the spoken output, a similar message can appear on screen **207**, and/or a distinctive auditory alert such as a beep may be sounded. In one embodiment, such reminder is provided in addition to automatic turn signal **212** activation as described above. In another embodiment, the system of the present invention merely provides reminders but does not automatically activate turn signal(s) **212**.

Steps **307** and **308** are performed as described in connection with FIG. **3**. If, in step **307**, vehicle **201** has arrived at the destination, the method ends **799**.

Example

Referring now to FIGS. **8**A through **8**C, there is shown an example of the operation of the present invention according to one embodiment.

In FIG. **8**A, vehicle **201** is 100 yards from intersection **801** where a right turn is to be performed, according to the determined route. Also shown in FIG. **8**A is an example of screen **802** as it might appear when vehicle **201** is 100 yards from intersection **801**. Map **802** is presented, along instruction **102** to turn right. As is known in the art, navigation system **202** may also output auditory instructions via speaker **220**. One skilled in the art will recognize that the depicted scenario is merely exemplary; for example, instruction **201** may be presented at any suitable distance from intersection **801**.

As described above, in some embodiments, the driver is reminded to manually activate turn signal **212** before automatic activation takes place. In FIG. **8**B, vehicle **201** is 60 yards from intersection **801**. Screen **802** now includes reminder **803** prompting the driver to activate right turn signal **212**. In one embodiment, spoken output can be provided instead of or in addition to visual reminder **803**, to prompt the driver to activate right turn signal **212**. One skilled in the art will recognize that the depicted scenario is merely exemplary; for example, reminder **803** may be presented at any suitable distance from intersection **801**. Alternatively, in some embodiments, reminder **803** is not displayed.

As described above, in some embodiments, turn signal **212** is automatically activated at a certain distance from the location where the specified maneuver (in this case a right turn) is to be performed. In FIG. **8**C, vehicle **201** is 30 yards from intersection **801**. Accordingly, navigation system **202** has sent a signal causing turn signal **212** to be automatically activated. In one embodiment, screen **802** includes a notification **804** informing the driver that turn signal **212** has been automatically activated. In one embodiment, spoken output can be provided instead of or in addition to visual notification **804**, to inform the driver that turn signal **212** has been automatically activated. Again, one skilled in the art will recognize that the depicted scenario is merely exemplary; for example, turn signal **212** may be automatically activated at any suitable distance from intersection **801**. Alternatively, in some embodiments, turn signal **212** may not be automatically activated. Alternatively, in some embodiments, turn signal **212** may be automatically activated, but notification **804** may be omitted or presented in some other form than that depicted in FIG. **8**C (for example, an auditory notification can be presented).

The present invention has been described in particular detail with respect to possible embodiments. Those of skill in the art will appreciate that the invention may be practiced in other embodiments. First, the particular naming of the components, capitalization of terms, the attributes, data structures, or any other programming or structural aspect is not mandatory or significant, and the mechanisms that implement the invention or its features may have different names, formats, or protocols. Further, the system may be implemented via a combination of hardware and software, as described, or entirely in hardware elements, or entirely in software elements. Also, the particular division of func-tionality between the various system components described herein is merely exemplary, and not mandatory; functions performed by a single system component may instead be performed by multiple components, and functions performed by multiple components may instead be performed by a single component.

In various embodiments, the present invention can be implemented as a system or a method for performing the above-described techniques, either singly or in any combination. In another embodiment, the present invention can be implemented as a computer program product comprising a nontransitory computer-readable storage medium and computer program code, encoded on the medium, for causing a processor in a computing device or other electronic device to perform the above-described techniques.

Reference in the specification to "one embodiment" or to "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiments is included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

Some portions of the above are presented in terms of algorithms and symbolic representations of operations on data bits within a memory of a computing device. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps (instructions) leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical, magnetic or optical signals capable of being stored, transferred, combined, compared and otherwise manipulated. It is convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like. Furthermore, it is also convenient at times, to refer to certain arrangements of steps requiring

physical manipulations of physical quantities as modules or code devices, without loss of generality.

It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussion, it is appreciated that throughout the description, discussions utilizing terms such as "processing" or "computing" or "calculating" or "displaying" or "determining" or the like, refer to the action and processes of a computer system, or similar electronic computing module and/or device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system memories or registers or other such information storage, transmission or display devices.

Certain aspects of the present invention include process steps and instructions described herein in the form of an algorithm. It should be noted that the process steps and instructions of the present invention can be embodied in software, firmware and/or hardware, and when embodied in software, can be downloaded to reside on and be operated from different platforms used by a variety of operating systems.

The present invention also relates to an apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general-purpose computing device selectively activated or reconfigured by a computer program stored in the computing device. Such a computer program may be stored in a nontransitory computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, flash memory, solid state drives, magnetic or optical cards, application specific integrated cir-cuits (ASICs), or any type of nontransitory media suitable for storing electronic instructions, and each coupled to a computer system bus. Further, the computing devices referred to herein may include a single processor or may be architectures employing multiple processor designs for increased computing capability.

The algorithms and displays presented herein are not inherently related to any particular computing device, virtualized system, or other apparatus. Various general-purpose systems may also be used with programs in accordance with the teachings herein, or it may prove convenient to construct more special-ized apparatus to perform the required method steps. The required structure for a variety of these systems will be apparent from the description provided herein. In addition, the present invention is not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the present invention as described herein, and any references above to specific languages are provided for disclosure of enablement and best mode of the present invention.

Accordingly, in various embodiments, the present invention can be implemented as software, hardware, and/or other elements for controlling a computer system, computing device, or other electronic device, or any combination or plurality thereof. Such an electronic device can include, for example, a processor, an input device (such as a keyboard, mouse, touchpad, trackpad, joy-stick, trackball, microphone, and/or any combination thereof), an output device (such as a screen, speaker, and/or the like), memory, long-term storage (such as magnetic storage, optical storage, and/or the like), and/or network connectivity, according to techniques that are well known in the art. Such an electronic device may be portable or nonportable. Examples of electronic devices that may be used for implementing the invention include: a mobile phone, personal digital assistant, smartphone, kiosk, server computer, enterprise computing device, desktop computer, laptop computer, tablet computer, consumer electronic device, television, set-top box, or the like. An electronic device for implementing the present invention may use any operating system such as, for example: Linux; Microsoft Windows, available from Microsoft Corporation of Redmond, Wash.; Mac OS X, available from Apple Inc. of Cupertino, Calif.; iOS, available from Apple Inc. of Cupertino, Calif.; and/or any other operating system that is adapted for use on the device.

While the invention has been described with respect to a limited number of embodiments, those skilled in the art, having benefit of the above description, will appreciate that other embodiments may be devised which do not de-part from the scope of the present invention as described herein. In addition, it should be noted that the language used in the specification has been principally selected for readability and instructional purposes, and may not have been selected to delineate or circumscribe the inventive subject matter. Accordingly, the disclosure of the present invention is intended to be illustrative, but not limiting, of the scope of the invention, which is set forth in the claims.

What is claimed is:

1. A method for automatically activating a turn signal in a vehicle operated by a human driver, comprising:

in a navigation device operating in the vehicle operated by the human driver, receiving a destination;

in the navigation device, determining a current location of the vehicle;

in the navigation device, determining a route to the destination based on the current location of the vehicle;

in the navigation device, generating an instruction for following the determined route, the instruction specifying a maneuver to be performed by the human driver at a specified location;

on an output device, and in advance of the vehicle reaching the specified location, outputting the generated instruction to the human driver;

subsequent to outputting the generated instruction, and in advance of the specified maneuver being performed by the human driver, determining whether the human driver has manually activated the turn signal to indicate the specified maneuver; and

in advance of the vehicle reaching the specified location, and in advance of the specified maneuver being performed by the human driver, and in response to a determination that the human driver of the vehicle has not manually activated the turn signal to indicate the specified maneuver, automatically sending a signal from the navigation device to a turn signal controller to cause the turn signal of the vehicle to be automatically activated, wherein the automatically activated turn signal indicates the maneuver specified by the instruction output to the human driver.

2. The method of claim **1**, further comprising, subsequent to automatically sending a signal from the navigation device to the turn signal controller to cause the turn signal of the vehicle to be automatically activated, and responsive to human driver input to cancel the turn signal, sending a signal to the turn signal controller to cause the turn signal to be deactivated.

3. A method for automatically reminding a human driver to manually activate a turn signal in a vehicle operated by the human driver, comprising:

in a navigation device operating in the vehicle operated by the human driver, receiving a destination;

in the navigation device, determining a current location of the vehicle;

in the navigation device, determining a route to the destination based on the current location of the vehicle;

in the navigation device, generating an instruction for following the determined route, the instruction specifying a maneuver to be performed by the human driver at a specified location;

on an output device, in advance of the vehicle reaching the specified location, outputting the generated instruction to the human driver;

subsequent to outputting the generated instruction, and in advance of the specified maneuver being performed by the human driver, determining whether the human driver has manually activated the turn signal to indicate the specified maneuver; and

on the output device, in advance of the vehicle reaching the specified location, and in advance of the specified maneuver being performed by the human driver, and in response to a determination that the human driver of the vehicle has not manually activated the turn signal to indicate the specified maneuver, automatically outputting a reminder to the human driver to manually activate the turn signal.

4. The method of claim **3**, further comprising, in response to a determination that the human driver has not manually activated the turn signal after the reminder has been output, automatically sending a signal from the navigation device to a turn signal controller to cause the turn signal of the vehicle to be automatically activated, wherein the automatically activated turn signal indicates the maneuver specified by the instruction output to the human driver.

5. A system for automatically activating a turn signal in a vehicle operated by a human driver, comprising:

an input device, configured to receive input specifying a destination for the vehicle operated by the human driver;

a geographical position determination device, configured to determine a current location of the vehicle;

a processor, communicatively coupled to the input device and to the geographical position determination device, configured to:

determine a route to the destination based on the current location of the vehicle; and

generate an instruction for following the determined route, the instruction specifying a maneuver to be performed by the human driver at a specified location;

an output device, communicatively coupled to the processor, configured to output the generated instruction to the human driver in advance of the vehicle reaching the specified location; and

a signal transmission device, communicatively coupled to the processor, configured to, in advance of the vehicle reaching the specified location, and in advance of the specified maneuver being performed by the human driver, and in response to a determination that the human driver of the vehicle has not manually activated the turn signal to indicate the specified maneuver, automatically send a signal to a turn signal controller to cause the turn signal of the vehicle to be automatically activated, wherein the automatically activated turn signal indicates the maneuver specified by the instruction output to the human driver;

wherein the processor is further configured to, subsequent to the output device outputting the generated instruction, and in advance of the specified maneuver being performed by the human driver, determine whether the human driver has manually activated the turn signal to indicate the specified maneuver.

6. The system of claim **5**, wherein, responsive to the input device receiving human driver input to cancel the turn signal, the signal transmission device sends a signal to the turn signal controller to cause the turn signal to be deactivated.

7. A computer program product for automatically activating a turn signal in a vehicle operated by a human driver, comprising:

a nontransitory computer-readable storage medium; and

computer program code, encoded on the medium, configured to cause at least one processor of a navigation device operating in the vehicle operated by the human driver to perform the steps of:

receiving a destination;

determining a current location of the vehicle;

determining a route to the destination based on the current location of the vehicle;

generating an instruction for following the determined route, the instruction specifying a maneuver to be performed by the human driver at a specified location;

in advance of the vehicle reaching the specified location, causing an output device to output the generated instruction;

subsequent to causing the output device to output the generated instruction, and in advance of the specified maneuver being performed by the human driver, determining whether the human driver has manually activated the turn signal to indicate the specified maneuver; and

in advance of the vehicle reaching the specified location, and in advance of the specified maneuver being performed by the human driver, and in response to a determination that the human driver of the vehicle has not manually activated the turn signal to indicate the specified maneuver, causing a signal to be automatically sent from the navigation device to a turn signal controller to cause the turn signal of the vehicle to be automatically activated, wherein the automatically activated turn signal indicates the maneuver specified by the instruction output to the human driver.

8. The computer program product of claim **7**, further comprising computer program code configured to, responsive to human driver input to cancel the turn signal, cause a signal to be sent to the turn signal controller to cause the turn signal to be deactivated.

9. A system for automatically reminding a human driver to manually activate a turn signal in a vehicle operated by the human driver, comprising:

an input device, configured to receive input specifying a destination for the vehicle operated by the human driver;

a geographical position determination device, configured to determine a current location of the vehicle;

a processor, communicatively coupled to the input device and to the geographical position determination device, configured to:

determine a route to the destination based on the current location of the vehicle; and

generate an instruction for following the determined route, the instruction specifying a maneuver to be performed by the human driver at a specified location;

an output device, communicatively coupled to the processor, configured to:

output the generated instruction to the human driver in advance of the vehicle reaching the specified location; and

in advance of the vehicle reaching the specified location, and in advance of the specified maneuver being performed by the human driver, and in response to a determination that the human driver of the vehicle has not manually activated the turn signal to indicate the specified maneuver, automatically output a reminder to the human driver to manually activate the turn signal;

wherein the processor is further configured to, subsequent to the output device outputting the generated instruction, and in advance of the specified maneuver being performed by the human driver, determine whether the human driver has manually activated the turn signal to indicate the specified maneuver.

10. The system of claim **9**, further comprising a signal transmission device, communicatively coupled to the processor, configured to, in response to a determination that the human driver has not manually activated the turn signal after the reminder has been output, automatically send a signal to a turn signal controller to cause the turn signal of the vehicle to be automatically activated, wherein the automatically activated turn signal indicates the maneuver specified by the instruction output to the human driver.

11. A computer program product for automatically reminding a human driver to manually activate a turn signal in a vehicle operated by the human driver, comprising:

a nontransitory computer-readable storage medium; and

computer program code, encoded on the medium, configured to cause at least one processor of a navigation device operating in the vehicle operated by the human driver to perform the steps of:

receiving a destination;

determining a current location of the vehicle;

determining a route to the destination based on the current location of the vehicle;

generating an instruction for following the determined route, the instruction specifying a maneuver to be performed by the human driver at a specified location;

in advance of the vehicle reaching the specified location, causing an output device to output the generated instruction to the human driver;

subsequent to causing the output device to output the generated instruction, and in advance of the specified maneuver being performed by the human driver, determining whether the human driver has manually activated the turn signal to indicate the specified maneuver; and

in advance of the vehicle reaching the specified location, and in advance of the specified maneuver being performed by the human driver, and in response to a determination that the human driver of the vehicle has not manually activated the turn signal to indicate the specified maneuver, causing the output device to automatically output a reminder to the human driver to manually activate the turn signal.

12. The computer program product of claim **11**, further comprising computer program code configured to, in response to a determination that the human driver has not manually activated the turn signal after the reminder has been output, cause the processor to automatically send a signal from the navigation device to a turn signal controller to cause the turn signal of the vehicle to be automatically activated, wherein the automatically activated turn signal indicates the maneuver specified by the instruction output to the human driver.

13. The method of claim **1**, wherein:

the location specified for the maneuver comprises at least one selected from the group consisting of: an intersection; an interchange; an entrance ramp; and an exit ramp; and

the maneuver comprises at least one selected from the group consisting of: a turn; an exit; an entrance; and a lane change.

14. The method of claim **1**, wherein determining the current location of the vehicle comprises determining the current location using a global positioning system.

15. The method of claim **1**, wherein the navigation device comprises a built-in component of the vehicle and is communicatively coupled to the turn signal controller of the vehicle.

16. The method of claim **1**, wherein the navigation device comprises a stand-alone device configured to enable transmission of a signal to the vehicle to cause the turn signal to be activated.

17. The method of claim **1**, wherein the navigation device comprises a stand-alone device configured to enable transmission of a signal to the turn signal controller of the vehicle.

18. The method of claim **1**, wherein automatically sending a signal from the navigation device to the turn signal controller to cause the turn signal of the vehicle to be activated comprises sending a signal by a wireless transmission medium.

19. The system of claim **5**, wherein:

the location specified for the maneuver comprises at least one selected from the group consisting of: an intersection; an interchange; an entrance ramp; and an exit ramp; and

the maneuver comprises at least one selected from the group consisting of: a turn; an exit; an entrance; and a lane change.

20. The system of claim **5**, wherein the geographical position determination device comprises a global positioning system (GPS) device.

21. The system of claim **5**, wherein the input device, the geographical position determination device, the processor, the output device, and the signal transmission device comprise built-in components of the vehicle, and wherein the signal transmission device is communicatively coupled to the turn signal controller of the vehicle.

22. The system of claim **5**, wherein the input device, the geographical position determination device, the processor, the output device, and the signal transmission device comprise components of a stand-alone navigation device configured to enable transmission of the signal to the vehicle.

23. The system of claim **5**, wherein the input device, the geographical position determination device, the processor, the output device, and the signal transmission device comprise components of a stand-alone navigation device configured to enable transmission of the signal to the turn signal controller of the vehicle.

24. The system of claim **5**, wherein the signal transmission device is configured to automatically send the signal from the navigation device to the turn signal controller by a wireless transmission medium.

25. The computer program product of claim **7**, wherein:

the location specified for the maneuver comprises at least one selected from the group consisting of: an intersection; an interchange; an entrance ramp; and an exit ramp; and

the maneuver comprises at least one selected from the group consisting of: a turn; an exit; an entrance; and a lane change.

26. The computer program product of claim **7**, wherein the computer program code configured to cause at least one processor to determine the current location of the vehicle comprises computer program code configured to cause at least one processor to determine the current location using a global positioning system.

27. The computer program product of claim **7**, wherein the computer program code configured to cause a signal to be automatically sent to the turn signal controller comprises computer program code configured to cause the signal to be sent by a wireless transmission medium.

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